Dissolution and Precipitation Reactions Between the Madison Limestone and Supercritical CO_2:

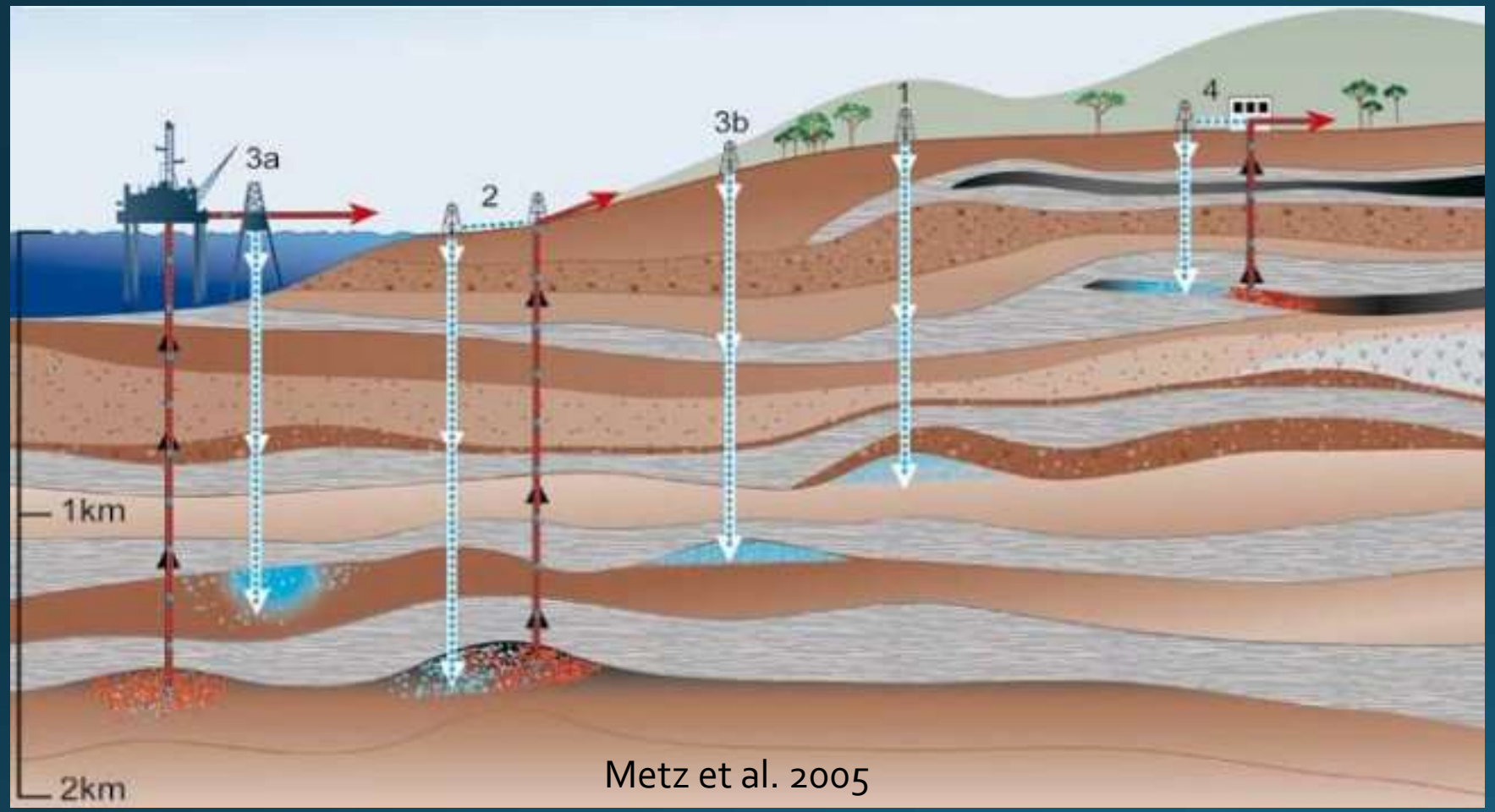
Implications for Carbon Capture and Storage in Southwest Wyoming

Steven Levesque

Outline

- Background-Carbon Capture and Storage
- Objectives and Hypothesis
- Geology: Rock Springs Uplift
- Experimental Approach
- Results
- Summary and Conclusions

Background- Carbon Capture and Storage



Metz et al. 2005

- What is Carbon Capture and Storage?
  - Storage of anthropogenic CO_2
  - CO_2 is injected within the subsurface into a reservoir rock
  - Ambient conditions allow for supercritical phase of CO_2
  - CO_2 migration is inhibited by an impermeable cap rock

Objectives and Hypothesis

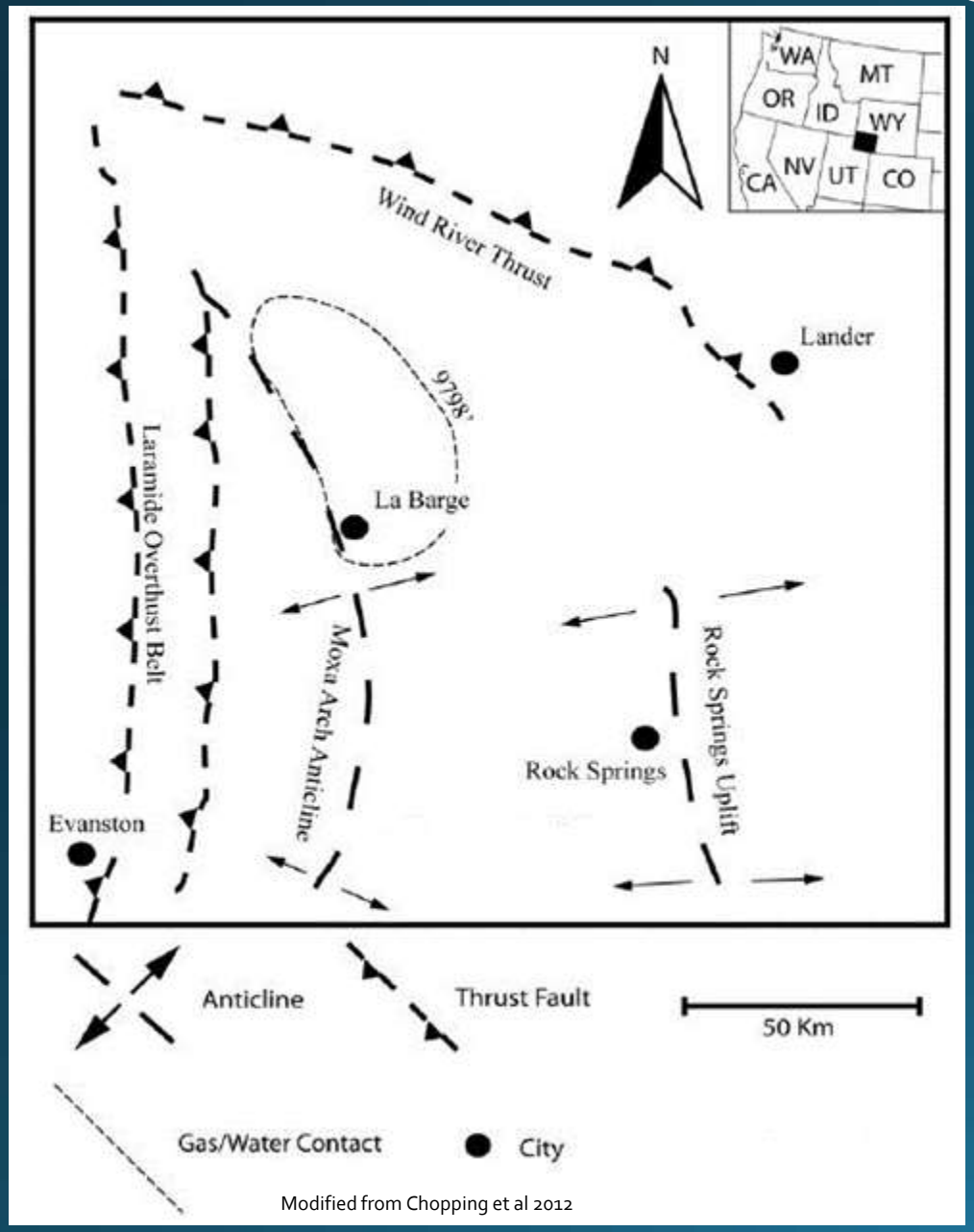
Objectives

- Experimentally simulate a geologic CO_2 storage reservoir
- Observe any mineral precipitation/dissolution from injection of supercritical CO_2

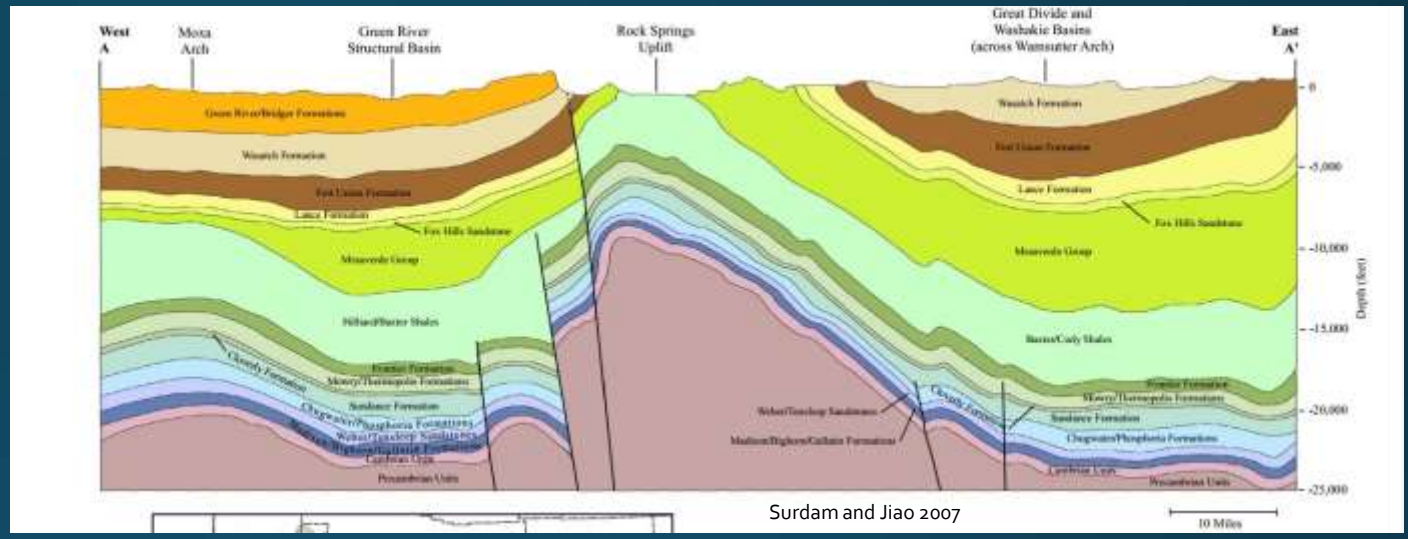
Hypothesis

- Reactions among the reservoir rock, brine, and supercritical CO_2 will cause mineral precipitation/dissolution

Geology: Rock Springs Uplift

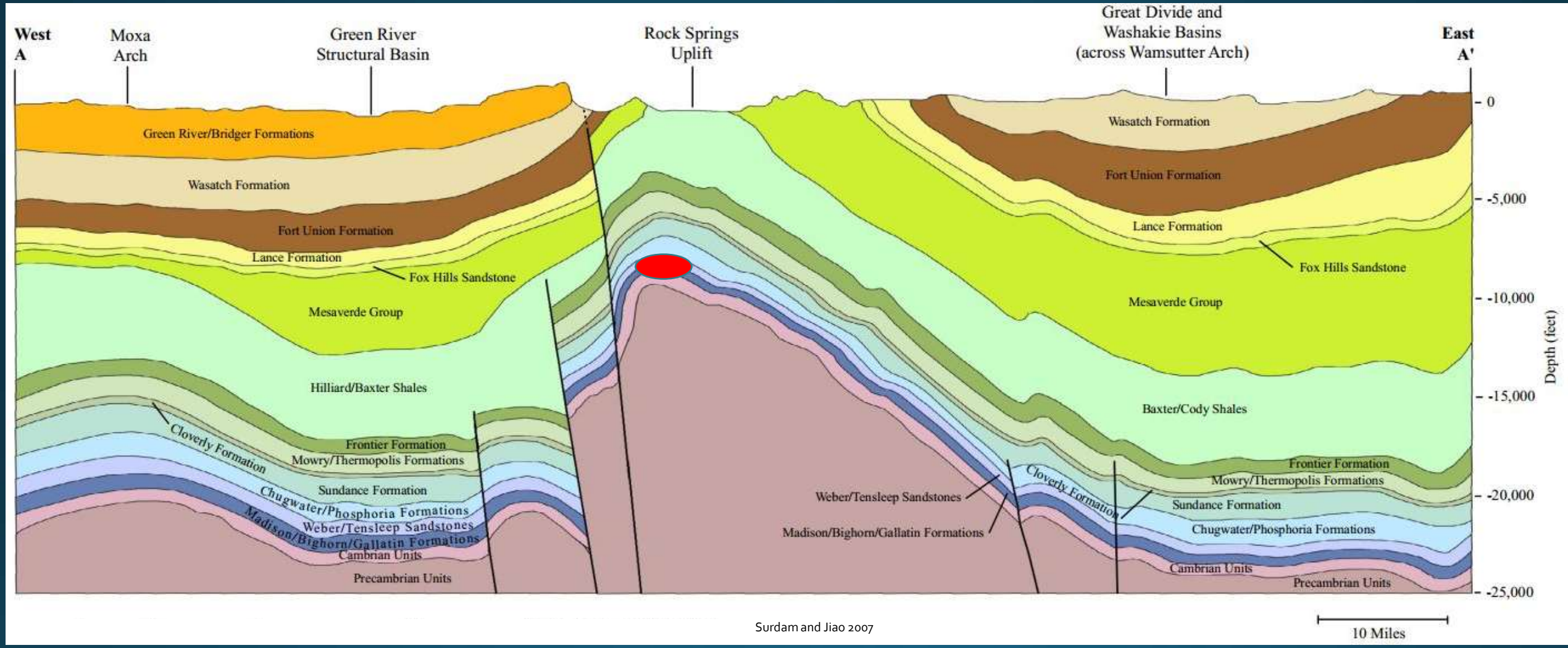


Modified from Chopping et al 2012



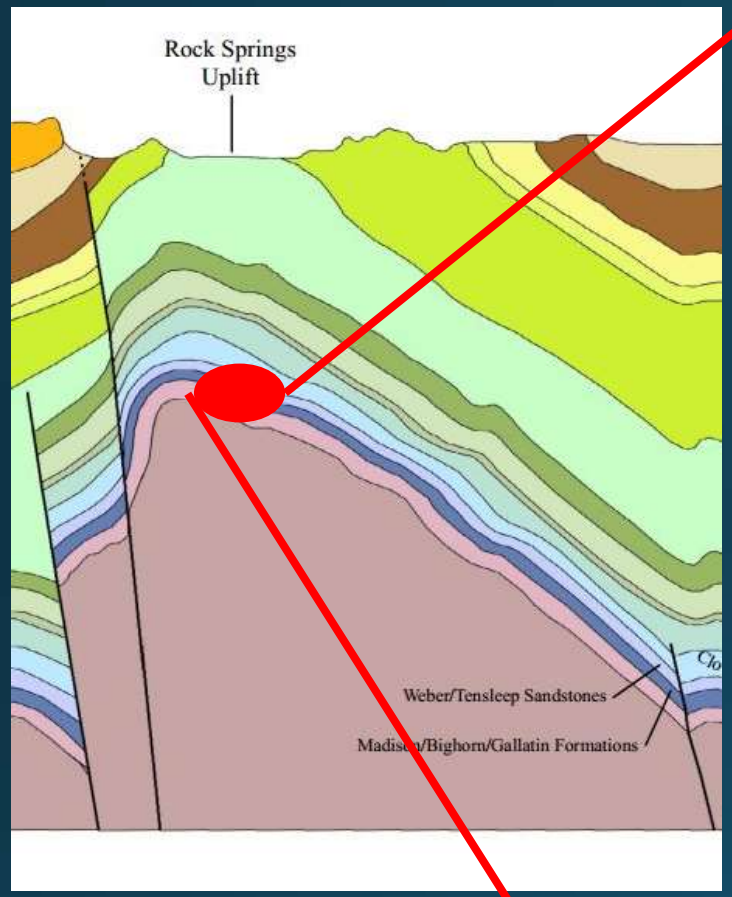
Surdam and Jiao 2007

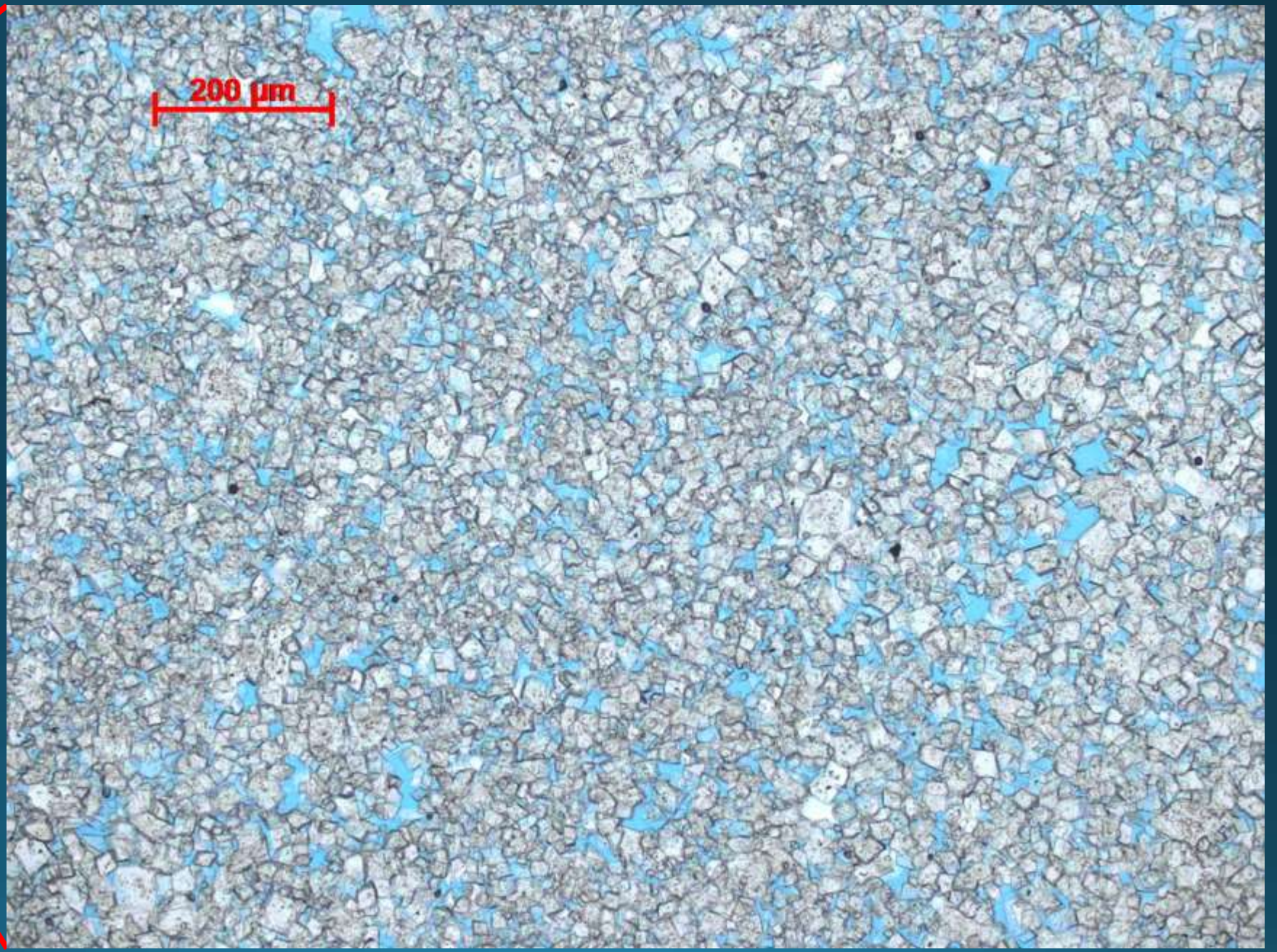
- Located in southwest Wyoming
- Doubly plunging anticline



Surdam and Jiao 2007

- Madison Limestone (12,350 ft)

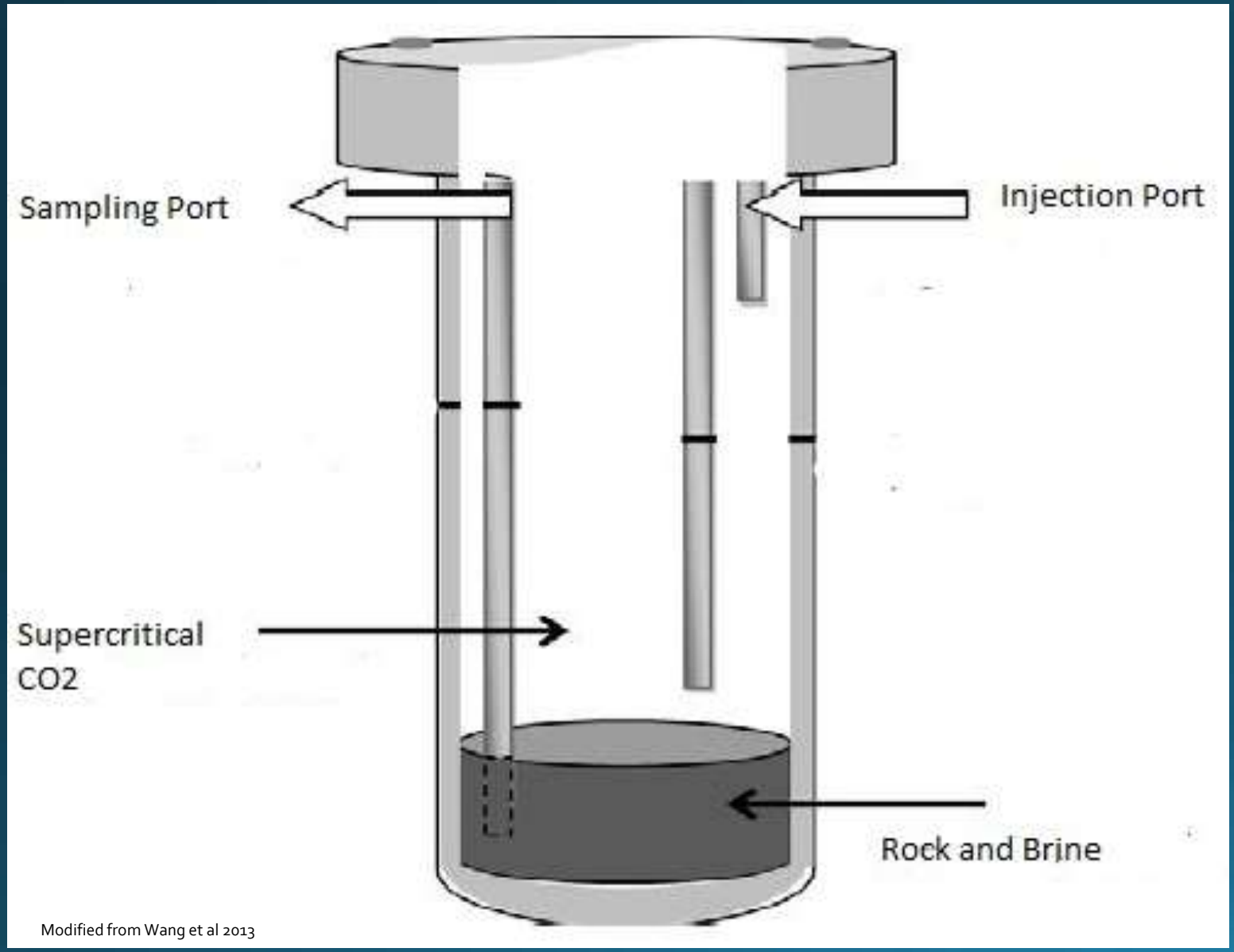




Madison Limestone (12,350 ft)

- Mg-rich Dolomite
- ~10% porosity

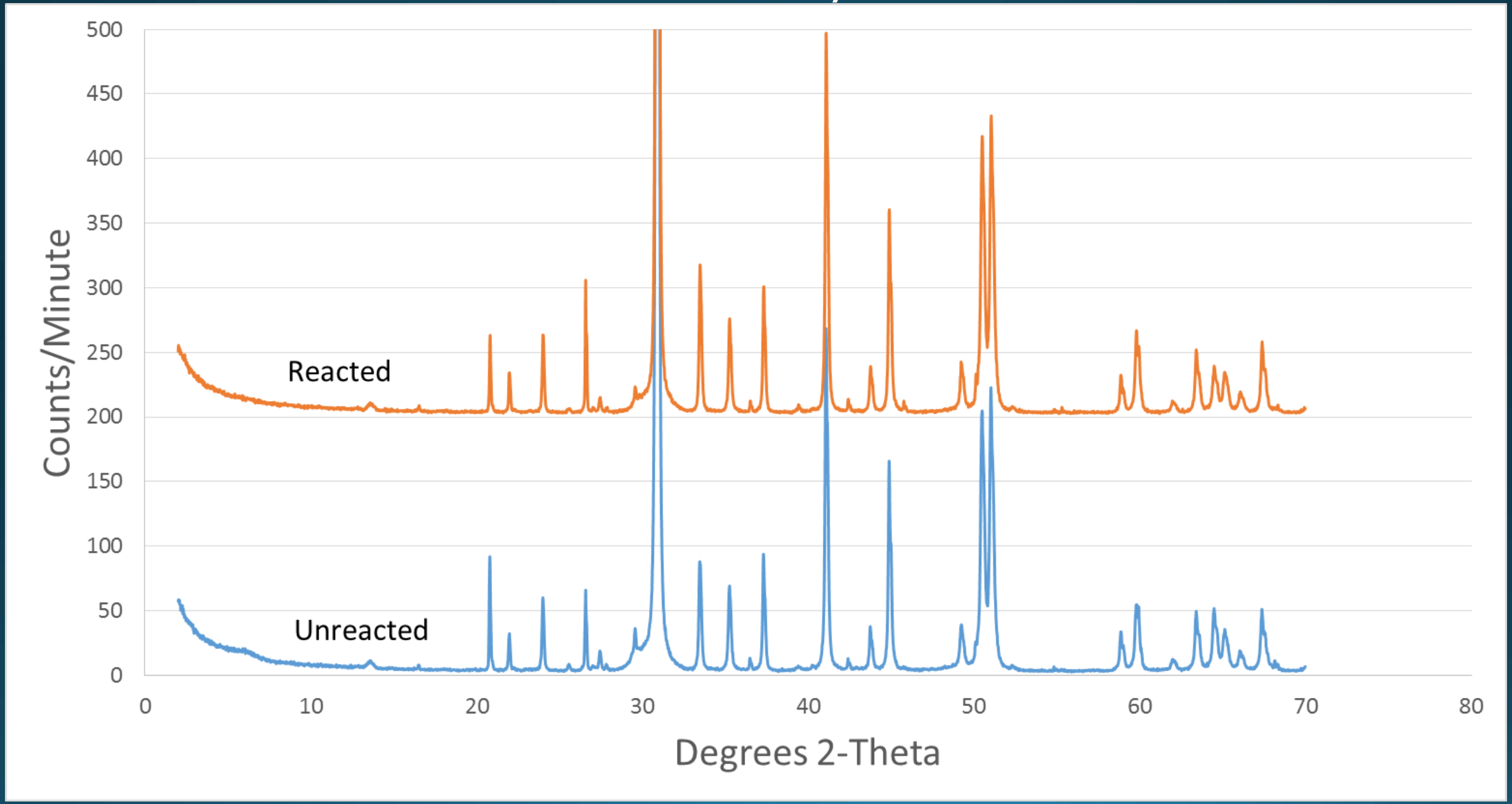
Experimental Approach



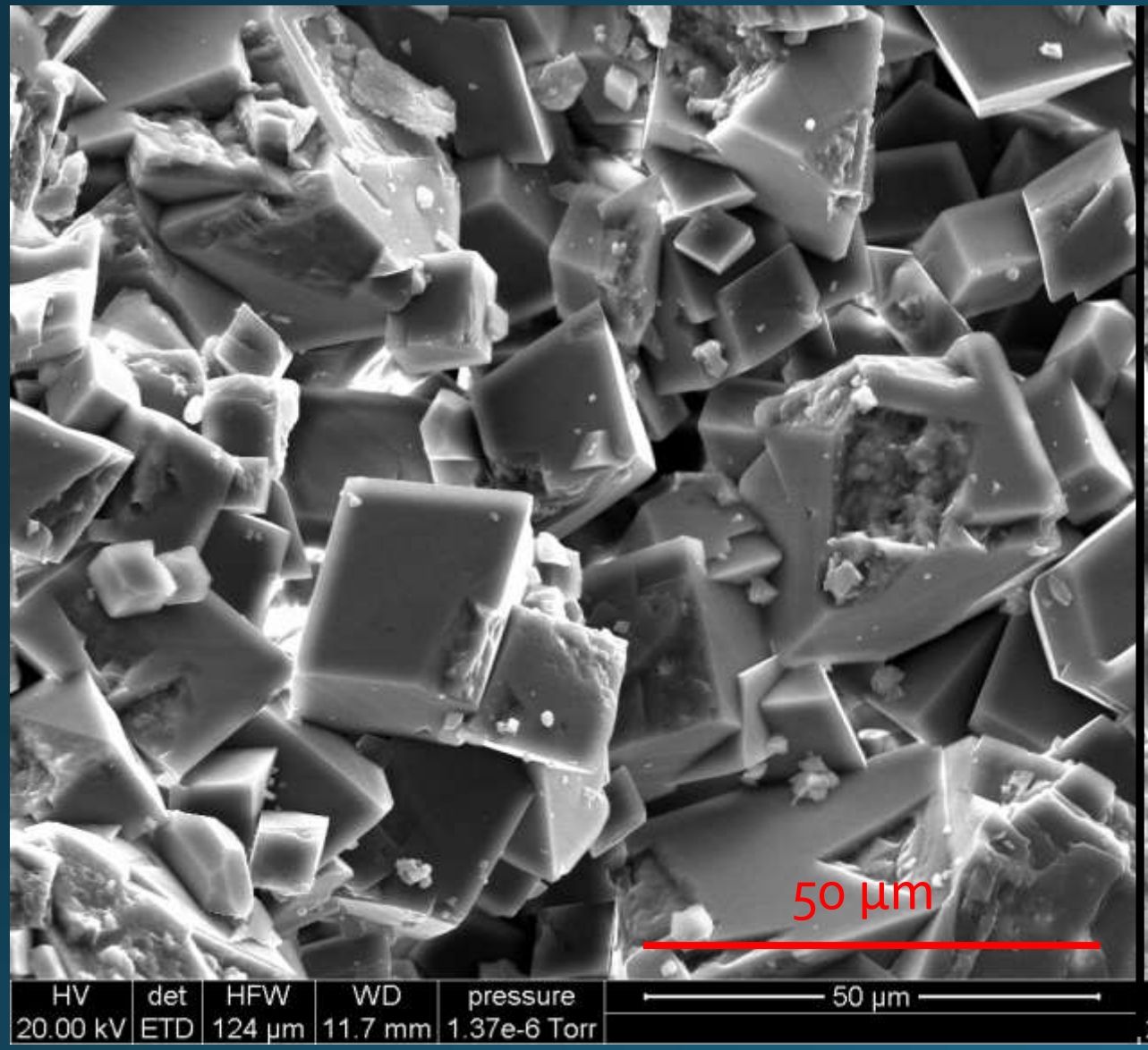
Modified from Wang et al 2013

- Purpose: Simulate in-situ reservoir conditions
- AE Bolted Closure Pressure Vessel (300mL)
- Duration: 354 hours
- Temperature: 100˚C
- Pressure: 345 Bars
- ~150 mL Brine + 7.5 g Rock, 20:1 water-rock ratio

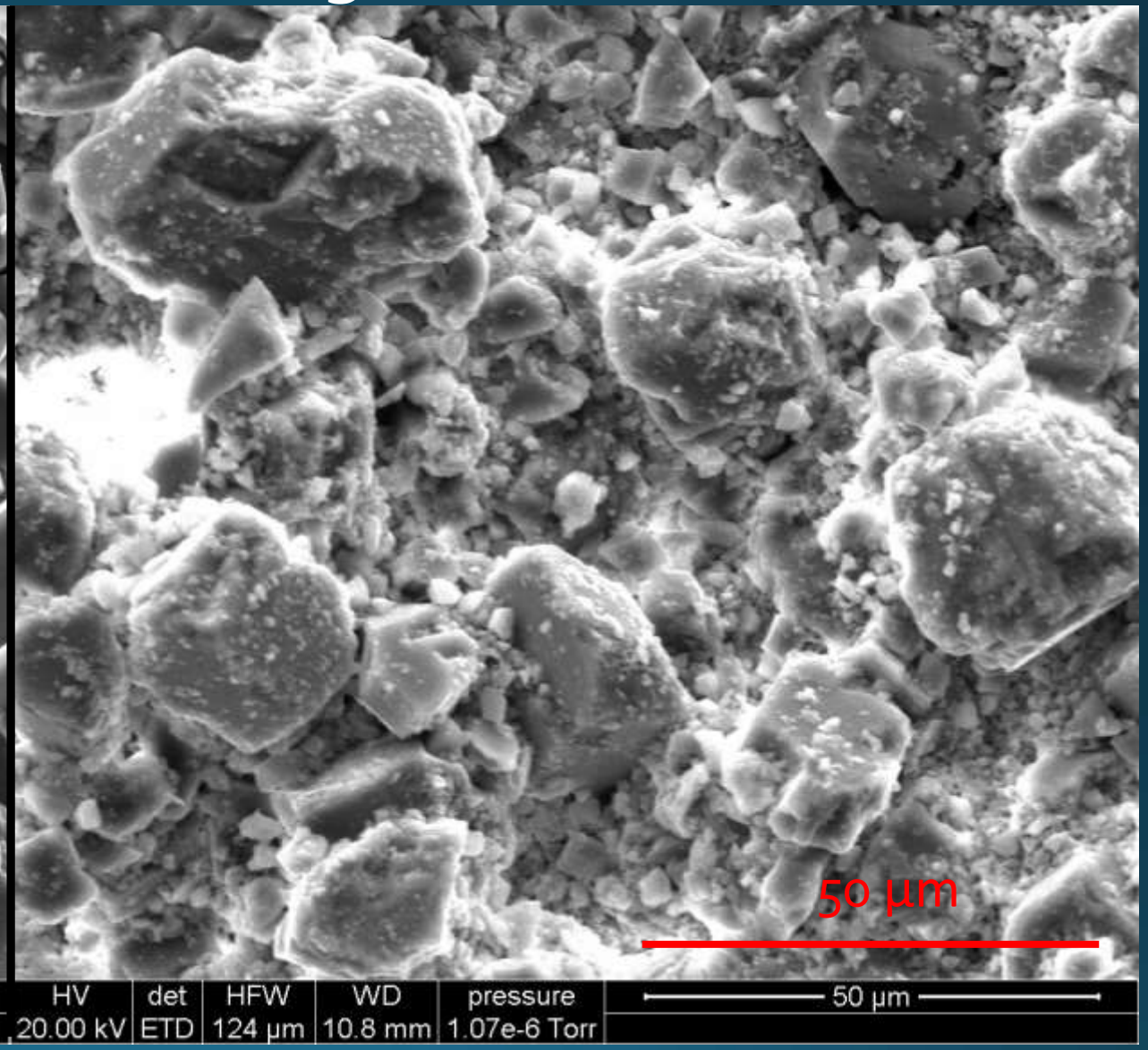
XRD Analysis



FE-SEM Textural Changes

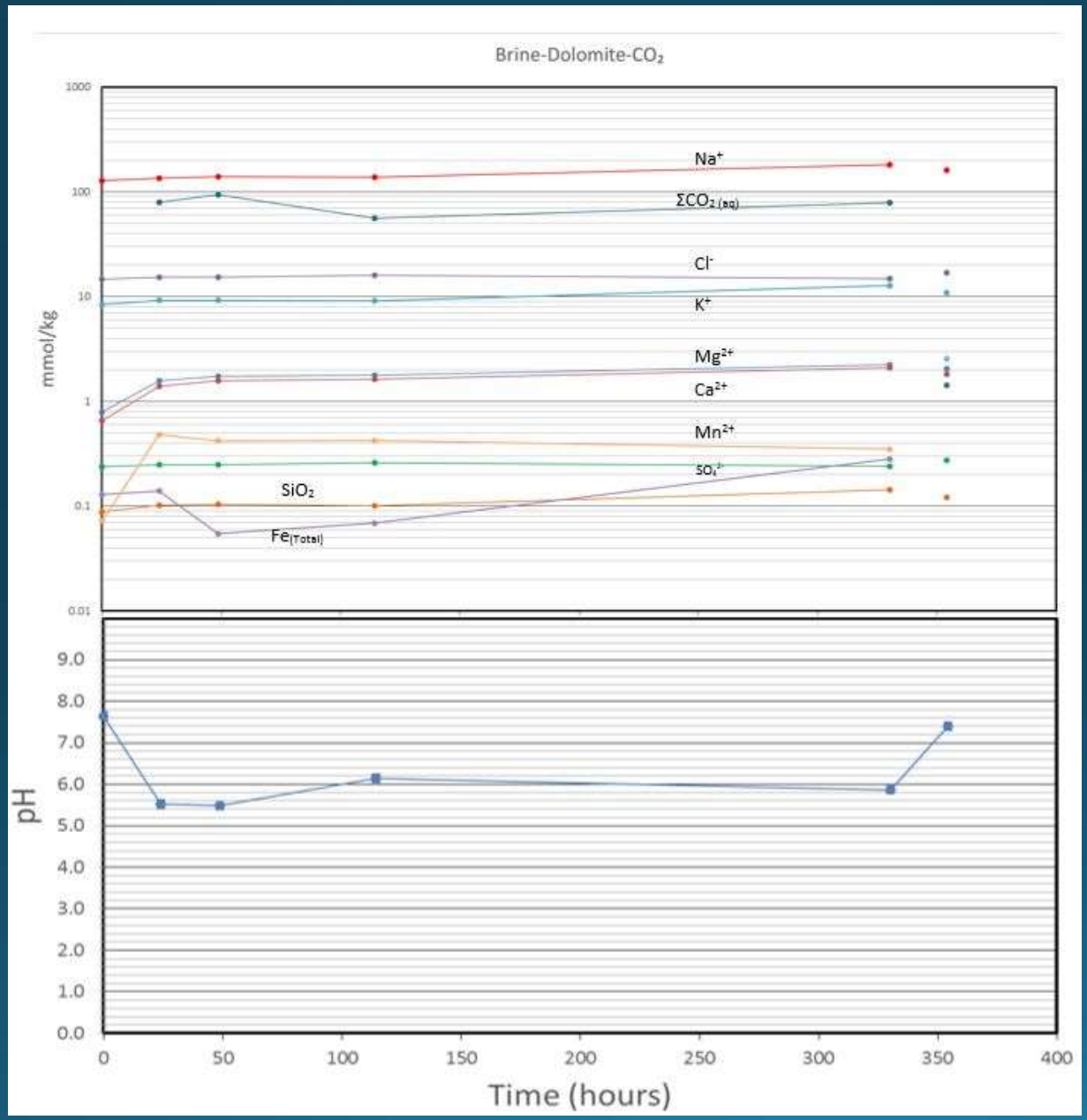


Unreacted



Reacted

Water Chemistry Evolution & pH vs. Time



Summary and Conclusions

- Dolomite dissolution reactions
  - Mineral surface texture changes
  - Increase in Mg and Ca throughout the experiment

Future Work

- Increase the duration of the experiments
- Geochemical modeling to predict in-situ changes in pH and mineral assemblages
- Porosity and permeability analyses
- Trace element analyses

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